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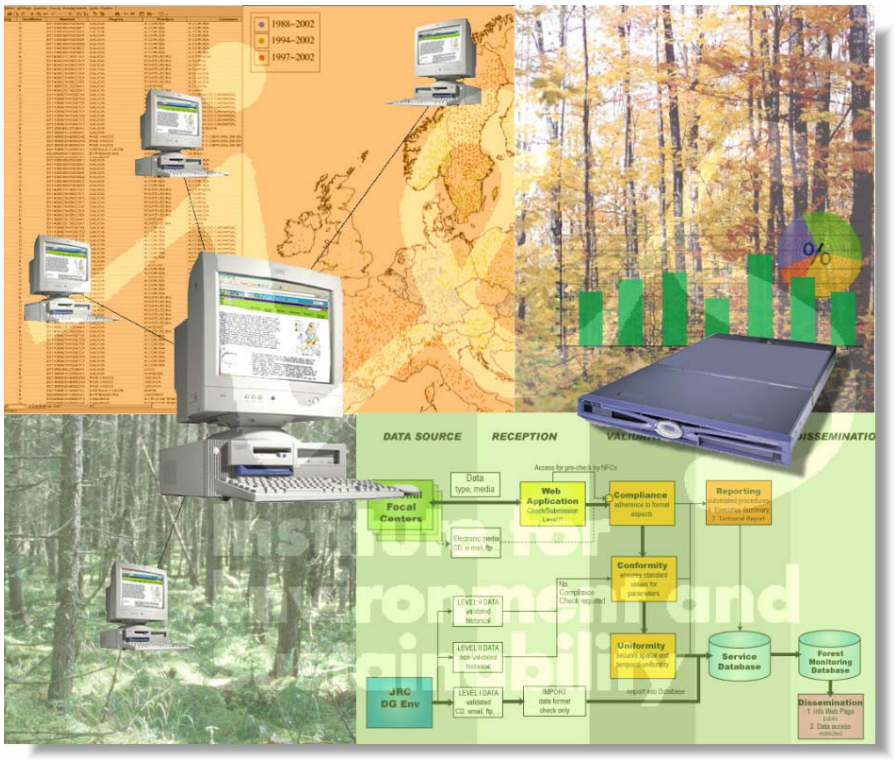
Forest Focus Monitoring Database System

EXECUTIVE SUMMARY REPORT 2001 LEVEL II DATA

Hiederer. R. T. Durrant, O. Granke, M. Lambotte, M. Lorenz. B. Mignon



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1 GENERAL INFORMATION

This *Executive Summary Report* for 2001 Level II data supplements the *Technical Report* for the same monitoring year. It presents a concise account of the data submitted and the results obtained from validating the data. Problems encountered with a general character and particularities with significant consequence on the overall project are included in the report. For details and technical background of the data and the validation process the *2001 Technical Report* should be referred to.

1.1 Background

Forest Focus (Regulation (EC) No 2152/2003[1]) is a Community scheme for harmonised, broad-based, comprehensive and long-term monitoring of European forest ecosystems. Under this scheme the monitoring of air pollution effects on forests is carried out by participating countries on the basis of the systematic network of observation points (Level I) and of the network of observation plots for intensive and continuous monitoring (Level II).

The Forest Focus monitoring activity continues from the network and plots established and implemented under previous schemes. From 1986 until the end of 2002 data were reported under the Council Regulation (EEC) No 3528/86[2]. The Regulation was later modified by Regulation (EC) No 804/2002, which amended Council Regulation (EEC) No 3528/86[3]. In 1991 a common monitoring system was agreed upon between the EU scheme and the *International Cooperative Programme on Assessment and Monitoring of Air Pollution Effects on Forests* (ICP Forests) under the *Convention of the Long-Range Trans-boundary Air Pollution* (CLRTAP).

Monitoring on Level II plots started in 1994. National Focal Centres (NFCs) compile and submit the data sampled on an annual basis. Until the monitoring year 2002 Level II data was processed and stored by the *Forest Intensive Monitoring Coordinating Institute* (FIMCI) under contract of DG AGRI. Following paragraph 15 of Forest Focus DG JRC is in charge of processing the monitoring data and has implemented for this purpose a Forest Focus Monitoring Database System (FFMDb). The system was developed and realized under contract by a Consortium, coordinated by I-MAGE Consult with Nouvelles Solutions Informatiques s.a. (NSI) as consortium partner and the Bundesforschungsanstalt für Forst- und Holzwirtschaft (BFH) as sub-contractor.

[1] OJ L 324, 11.12.2003, p. 1-8
[2] OJ L 326, 21.11.1986, p.2-4
[3] OJ L 132, 17.05.2002, p.1-2

Forest Focus stipulates that data from all Level I and Level II surveys be integrated in a single system. Accordingly, the new system also includes data collected under the previous schemes, which for Level II surveys are referred to as *legacy data*. This report details the situation of the Level II legacy data for 2001 with respect to the validation process applied to data collected under Forest Focus for subsequent monitoring data. The main aim of processing the data is to identify any consequences of the legacy data on the results of validating data from subsequent years.

1.2 Reporting

The objective of the reporting task is to provide a comprehensive account on the data provided for a given monitoring year in form of standardized documents. The main objective of the *2001 Technical Report* is to improve the understanding of the effect of the legacy data on the results of the validation process of data collected under Forest Focus. Consequently, changes between 2001 and subsequent years mainly for static parameters were evaluated in detail. In addition, the report includes analyses of spatial variability and temporal trends of parameters. Maps, graphs and tables are included in the report and serve as support for this analysis. Comments on the data status for each NFC with respect to the parameter assessed are provided in the Annex.

The *Technical Reports* are accompanied by *Executive Summary Reports*. It accompanies the *Technical Report* as a separate item and highlight peculiarities of the year, which have had an effect on the data. The *Executive Summary* summarises the main findings and items in a language and presentation that is targeted at a broader audience that does not have specific technical expertise.

2 GENERAL INFORMATION ON LEGACY DATA

An overview over the generic flow of data in the operational system and the various stages of data processing of Forest Focus and the legacy data are presented in form of a schematized standard data flow in Figure 1.

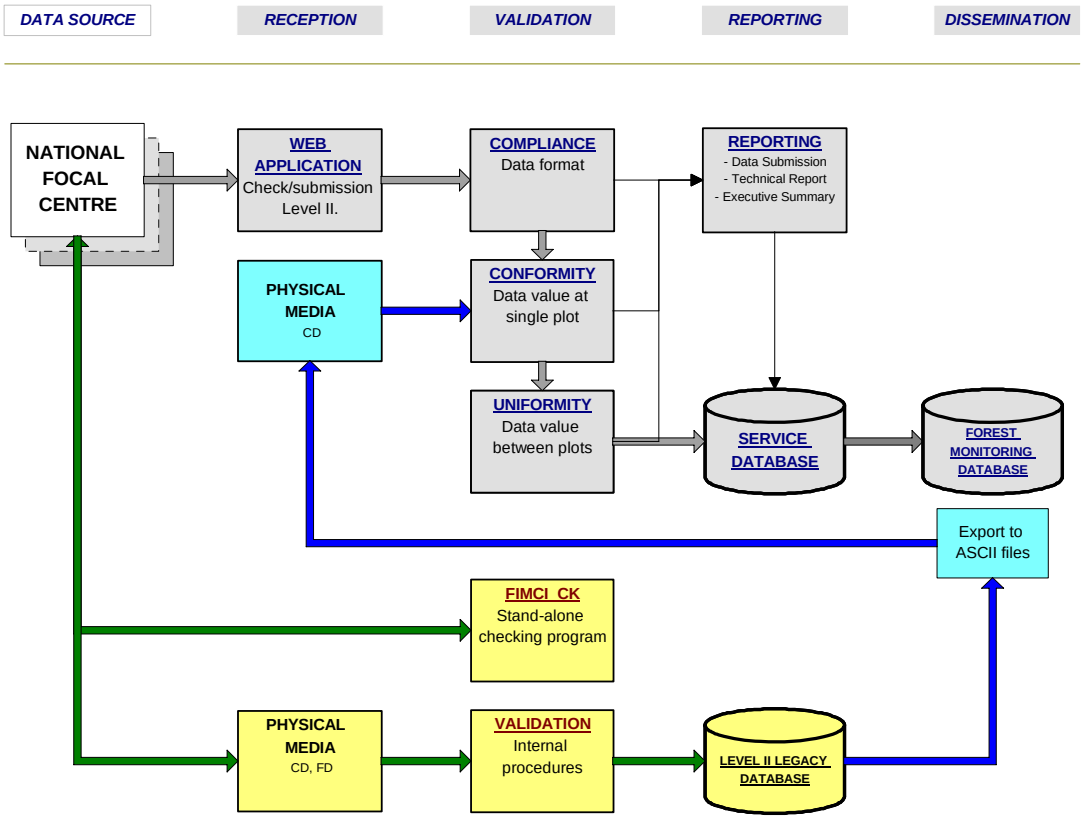

Figure 1: Schematized Standard Data Flow

The graph shows that the Level II legacy data integrated into the FFMDb followed a very different path from Forest Focus monitoring data.

Under Forest Focus all Level II data pass through the Web-based Data Submission Module. The module provides on-line tests for data compliance. Only data submitted through the module enter the subsequent processing stages.

Legacy data were sent by NFCs quite often on physical media to FIMCI, generally on 3.5” floppy disk and later also on CD. The data could be verified by NFCs using an

independent checking program (FIMCI_CK). The use of the program was under the responsibility of the NFCs. Data received by FIMCI were subjected to a series of validation procedures and up-loaded into the legacy database.

2.1 Data Source

The legacy data used in the FFMDb originates from a delivery made by FIMCI to DG AGRI from August, 2003. The data were stored on CD and in ASCII text format. The files provided contained the data as processed by FIMCI. Not available were any original data as sent by the NFCs to either FIMCI or DG AGRI.

2.2 Data Validation

For all legacy data it is assumed that the surveys are fully validated according to the procedures applied at the time. The data are therefore not validated, but analysed with respect to the validation procedures applied under Forest Focus. Because original data are not available the check of formats of data submitted by NFCs in the ASCII files is not applicable. The lack of the original files also prevents a comparison between data submitted by NFCs and data stored in the database. The initial check of the data based on a stand-alone program also allows data to be submitted, which were not passed through the program.

Under the validation procedure of Forest Focus the first group of tests (Compliance Check) are applied at the time of data submission. The check concerns the compliance of the data with the format specifications stipulated in the Technical Specifications of DG JRC. Such checks cannot be applied to the legacy data, because only data from the validated database are available.

Legacy data from 2001 were therefore processed using the tests for Conformity and Uniformity. However, in case of an error the situation was treated differently from normal routine. Because it had to be assumed that all data were previously validated and found correct the tests could only trigger a warning and thus allow the data to be passed on to the next stage of processing.

2.3 Dissemination

Legacy data are distributed as any other Forest Focus data using the Data Dissemination Module of the system. Compared to data collected under Forest Focus the number of surveys and NFCs is reduced. Some surveys were only introduced after the period covered by the legacy data, such as the Ozone Injury survey. Other NFCs of Forest Focus only started submitting data with the 2002 monitoring year or later.

3 DATA PROCESSING OF 2001 LEVEL II LEGACY DATA

The data processing stages described hereunder present the procedure adapted from the Forest Focus validation process to analyse legacy data from 2001. Legacy data have already been validated. It has to be assumed that any data stored in the legacy database have been confirmed by the NFCs. As a consequence, the *2001 Technical Report* was limited to the application of Forest Focus Conformity and Uniformity checks.

3.1 Surveys for 2001 Monitoring Year

An overview of the number of NFCs and surveys with data received from the export files from 2001 legacy data is given in Figure 2. As indicated in the graph data from 24 NFCs are included in the files received.

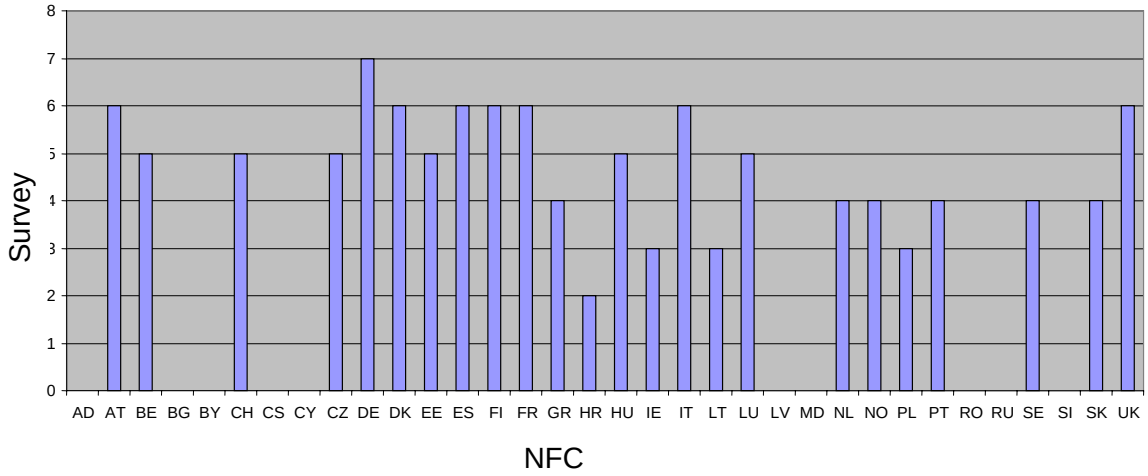

Figure 2: Number of Surveys in 2001 Level II Data

More detailed information on the data exported from the legacy database by Forest Focus survey for 2001 is given in Table 1.

Table 1: Surveys Exported from Legacy Database for the Year 2001

2001	SI	CC	SO	SS	FO	GR	DP	MM	GV	AQ	TOTAL
AD											
AT		X		X	X		X	X	X		6
BE		X		X	X		X	X			5
BG											
BY											
CH		X		X	X		X	X			5
CS											
CY											
CZ		X		X	X		X	X			5
DE		X		X	X	X	X	X	X		7
DK		X		X	X		X	X		X	6
EE		X		X	X		X		X		5
ES		X		X	X		X	X		X	6
FI		X		X	X		X	X	X		6
FR		X		X	X	X	X			X	6
GR		X			X		X	X			4
HR		X			X						2
HU		X			X		X	X	X		5
IE		X			X	X					3
IT		X		X	X		X	X	X		6
LT		X		X			X				3
LU		X			X		X	X		X	5
LV											
MD											
NL		X		X	X		X				4
NO		X		X	X		X				4
PL		X			X		X				3
PT		X			X		X		X		4
RO											
RU											
SE		X		X			X	X			4
SI											
SK		X			X	X	X				4
UK		X		X	X		X	X	X		6
TOTAL		24		16	22	4	22	14	8	4	114

The total number of survey for year 2001 is 114. The number of survey varies according to the NFC: it ranges from 2 surveys for Hungary to 7 surveys for Germany. Data for the mandatory Crown Condition survey, which is assessed on an annual basis, have been submitted by all 24 NFCs. No data have been submitted for Soil Condition, which is sampled every 10 years. The surveys for Phenology, Ozone Injury and Litter Fall were added to the list of surveys only after 2001. No data could be specified for System

Instalment forms. The corresponding files would only have been available in original formats from NFCs.

3.2 Conformity Analysis

An overview on the number of tests performed on the data for Conformity and the respective number of tests generating an error or a warning (messages) is given in Table 2.

Table 2: Summary Conformity Test for all Countries, year 2001

Country	Number of Tests for Conformity	Number of Tests with Messages
Andorra		
Austria	110	9
Azores (Portugal)		
Belarus		
Belgium	153	25
Bulgaria		
Canaries (Spain)		
Croatia	30	1
Cyprus		
Czech Republic	124	5
Denmark	101	7
Estonia	70	2
Finland	152	19
France	124	4
Germany	179	41
Greece	72	9
Hungary	103	13
Ireland	52	4
Italy	148	28
Latvia		
Lithuania	40	1
Luxembourg	118	7
Netherlands	75	2
Norway	55	0
Poland	68	3
Portugal	49	3
Republic of Moldova		
Romania		
Russia		
Serbia		
Slovak Republic	78	5
Slovenia		
Spain	71	15
Sweden	76	8
Switzerland	102	14
United Kingdom	110	6
TOTAL	**2260**	**236**

In total 2260 tests were performed on the surveys. The surveys passed 90% of the tests, but 236 tests caused the system to highlight a situation with a message. Some errors or warnings were detected in one or more surveys from all NFCs. All results of the tests are stored in the FFMDb, which will allow an improved evaluation of the data quality for further use of the data.

3.3 Conformity Status of 2001 Data

The data conformity status for the surveys of the 2001 monitoring year is summarized in Table 3. Most of the messages detected by the single parameter range checks were located in the Meteorology survey. The survey with the second-frequent messages is soil solution. The proportion of the number of messages for Soil Solution is low by comparison: not even 2% (305 of 18860) of the messages were triggered by values received in the Soil Solution data. It is remarkable that no unusual situations were found in the data of the Deposition survey by the single parameter range checks.

All messages triggered by the range test for the spatial position of a country were caused by an incorrect setting in the checking routine for Estonia. The settings were corrected in the routines of the Conformity Check of the operational system. Except for Air Quality all errors in the range test for the longitude coordinate were due to an incorrect minus for one plot in Germany.

Most of messages in the tests for temporal consistency were caused by new trees in the data. Additional multi-parameter range checks found 891 situations in the Growth survey data that triggered messages. Those situations were found in only three NFCs (France, Germany and the Slovak Republic).

Table 3: Data Conformity Status 2001 by NFC and Survey

2001	SI	CC	SO	SS	FO	GR	DP	MM	GV	AQ
AD										
AT		✓		✓	N		✓	N	✓	
BE		N		✓	N		✓	N		
BG										
BY										
CH		N		N	N		✓	N		
CS										
CY										
CZ		✓		✓	N		✓	N		
DE		N		N	N	N	N	N	✓	
DK		N		✓	N		✓	N		N
EE		✓		✓	N		✓		✓	
ES		✓		✓	N		✓	N		N
FI		N		N	N		✓	N	✓	
FR		N		N	N	N	✓			✓
GR		✓			N		✓	N		
HR		N			✓					
HU		N			N		✓	N	✓	
IE		✓			N	N				
IT		N		✓	N		N	N	✓	
LT		N		✓			✓			
LU		N			✓		✓	N		✓
LV										
MD										
NL		N		✓	N		✓			
NO		✓		✓	✓		✓			
PL		N			N		✓			
PT		✓			✓		✓		N	
RO										
RU										
SE		✓		✓			N	N		
SI										
SK		N			N	N	✓			
UK		N		N	N		N	N	N	
Conform		9		11	4	0	18	0	6	2
Rel. %		37.5		68.8	18.2	0.0	81.8	0.0	75.0	50.0

✓: Data conform
N: Data not conform

3.4 Uniformity Analysis

The tests of data Uniformity provide an interpretation of temporal and spatial development of parameters using data from more than one plot. For the analysis of the legacy data all surveys were used in the process. The tests include an automatic procedure for generating maps for various key parameters monitored. In general, the map depicts the status of a given parameter for the monitoring year. Where appropriate a status map is supplemented by a map showing changes over a previous monitoring year. While the compilation of the maps is relatively straightforward for continuous surveys the process is less apparent for surveys with longer monitoring intervals, such as Growth or Soil Condition. The main obstacle for comparing data to results from other plots or analysing changes over time is the lack of data for any given monitoring year. This is most extreme for the Soil Condition survey with a repeat cycle of 10 years. On average one would expect data for 10% of all plots for a monitoring year, which is largely insufficient for a comparative analysis. Therefore, for non-annual surveys data from several preceding years are used in the analysis. The findings are presented for Crown Condition, Soil Solution, Foliar Condition and Deposition.

3.4.1 Crown Condition

Mean plot defoliation in 2001 is mapped for the six main tree species *(Pinus sylvestris, Picea abies, Fagus sylvatica, Quercus robur and Q. petraea, Quercus ilex and Q. rotundifolia, Pinus pinaster).* The maps show those Level II plots on which at least three trees of the respective tree species were assessed in the reporting year. For each plot, mean defoliation is classified into 6 classes (0-10%, 11-20%, 21-30%, 31-40%, 41-50%, 51-100%).

The mean plot defoliation of *Pinus sylvestris* in 2001 is presented in Figure 3. The highest density of validated mean defoliation data for *Pinus sylvestris* is found in southern Sweden and Poland. Many plots in Sweden show a mean defoliation between 0 and 20%, but there are also some plots showing defoliation of up to 30% and one with up to 50%. Most of the plots in Poland reach values between 11 and 30% defoliation and a few trees reach up to 40% mean defoliation.

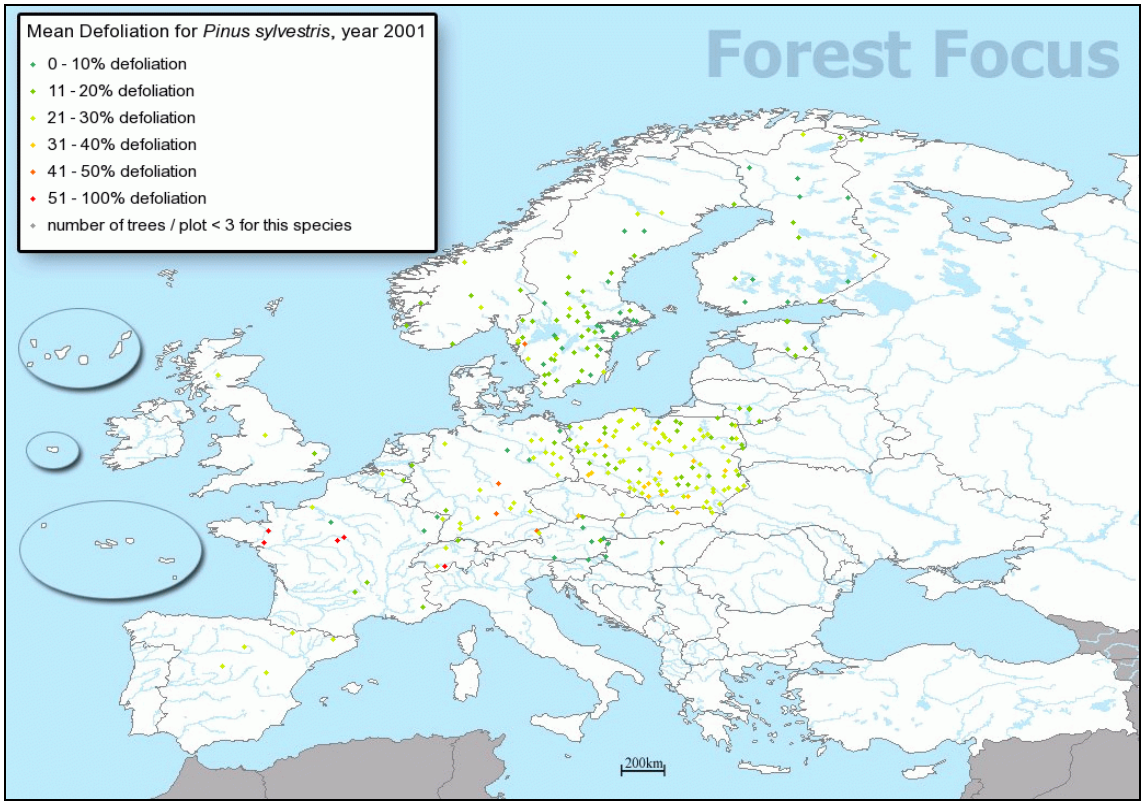

Figure 3: Mean Defoliation for Pinus Sylvestris

The high density of Level II plots and their relatively small spatial variation of the degree of defoliation in southern Sweden and Poland suggests a comparison with defoliation assessed on Level I plots in the same regions. The comparison shows that defoliation assessed at the two monitoring levels is quite similar. Most of the Swedish Level I plots show also a mean defoliation between 0 and 20%, many plots reaching between 21% and 30% and a few plots even 31% to 40% defoliation (Lorenz *et al.*, 2002). Mean plot defoliation on Level I plots in Poland ranges between 21 and 40%, i.e. it is slightly higher than on the Level II plots.

The variability of defoliation on most of the plots in Norway, Finland, Estonia, Lithuania, Austria, Belgium, United Kingdom, and Spain is similar to that described on the Swedish and Polish plots. There are, however, three plots with defoliation ranging from 41% to 50% (in Germany) and four plots ranging from 51% to 100% defoliation (in France and Switzerland).

The spatial variation of mean plot defoliation for *Picea abies* is shown in Figure 4. By far the largest amount of validated data is available for plots located in southern Sweden, Austria and Germany. Defoliation on the plots in Austria is mostly no higher than 10%. Also in southern Sweden those plots with defoliation up to 10% are dominating, but there are also several plots showing defoliation of up to 20%. The same applies to the much scarcer plots in Finland, Lithuania, Denmark, the north of Italy and the central and eastern parts of France. Higher variability and much higher levels of

mean plot defoliation, sometimes exceeding 50%, were reported for plots in Norway, Czech Republic, Slovak Republic, Switzerland, and Germany. These results are comparable to those described for the Level I plots for the year 2001 (Lorenz *et al.*, 2002).

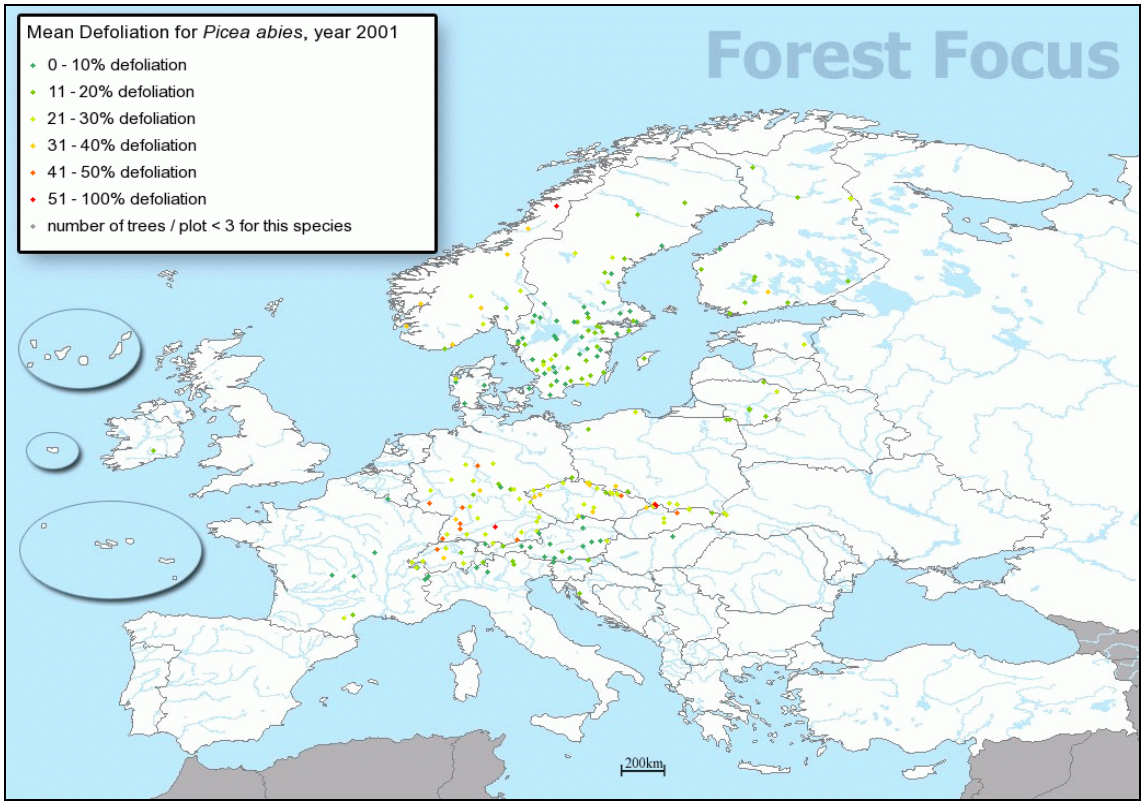

Figure 4: Mean Defoliation for Picea Abies

A map of mean plot defoliation of *Fagus sylvatica* on Level II plots in 2001 is given in Figure 5. Mean plot defoliation is lowest in Austria, Denmark, Belgium, Switzerland, Hungary and Italy with mainly up to 10% and only in exceptional cases with 11% to 20%. In southern Sweden, Poland, Germany, France, Spain, Czech Republic and Slovak Republic the mean plot defoliation is more variable with maximum values of up to 40%. Defoliation is smaller on the *Fagus sylvatica* plots than on the *Pinus sylvestris* and *Picea abies* plots at Level II. This does not coincide with the findings from Level I in 2001. The reason for this lies clearly in the different densities of the Level I and Level II samples. For instance, in Italy mean plot defoliation is maximally up to 20% on the Level II plots but may reach up to 50% on some Level I plots.

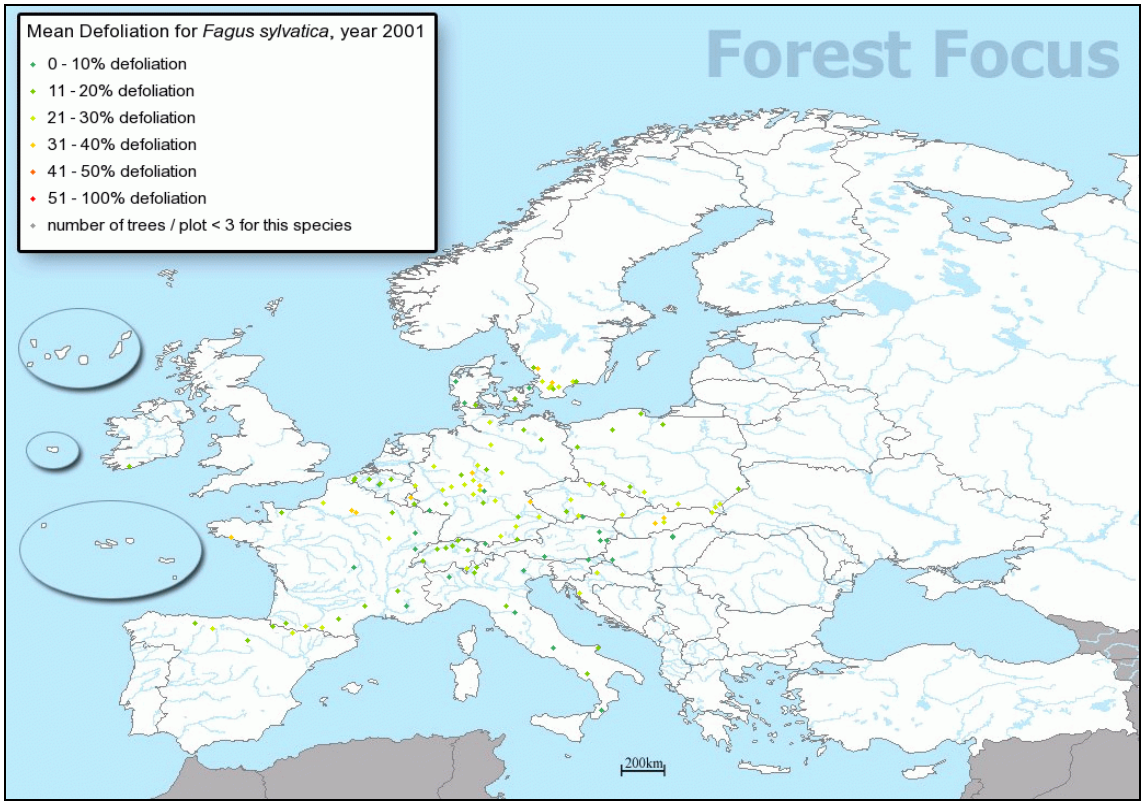

Figure 5: Mean Defoliation for Fagus Sylvatica

Mean plot defoliation of *Quercus robur* and *Qu. petraea* in 2001 is mapped in Figure 6. For these species the Level II plots show a wide range of defoliation. Defoliation is particularly low on plots in Denmark, Austria, Hungary and some parts of France and the United Kingdom with values below 20%. For the plots in southernmost Sweden, Germany, Czech Republic and Spain much higher levels of mean defoliation were reported, sometimes exceeding 50%. Due to the limited geographic spread and the high spatial variation a comparison with the results of the assessment on Level I plots would be inappropriate. However, the relatively high defoliation showing high spatial variation is also found at Level I.

The number of Level II plots for the other species assessed is rather limited and given in the *2001 Technical Report*.

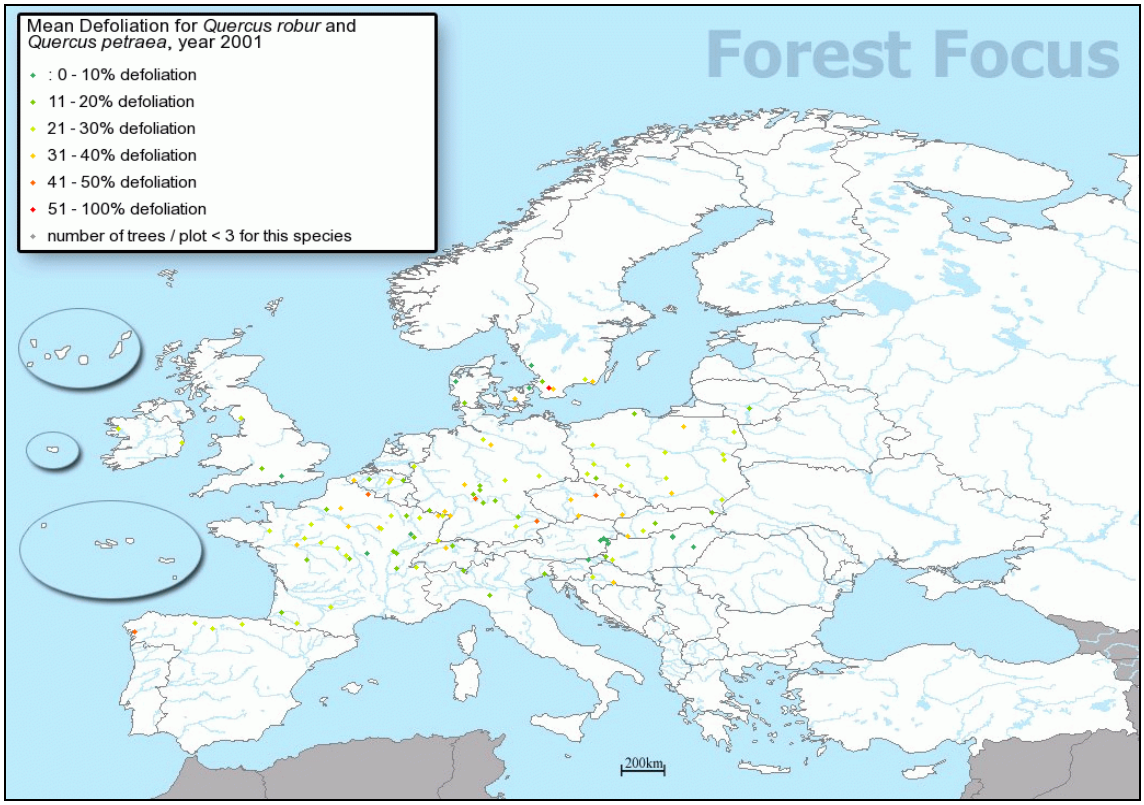

Figure 6: Mean Defoliation of Quercus Robur and Qu. Petraea

3.4.2 Soil Solution

Key parameters of the Soil Solution survey tests are the concentrations of sulphur (S-SO_4), and nitrogen (N-NO_3 and N-NH_4). The difference between the time-weighted mean concentration in the reporting year and the average of the weighted mean concentration of the five preceding years is evaluated as part of the tests. Not all soil solution data stored in the FMD are necessarily displayed on the map.

The data for 2001 for the parameter S-SO_4 are shown in Figure 7. For plots located in Norway, the United Kingdom, Germany, France, Switzerland, Austria, and Belgium as well as for one plot in Lithuania and one plot in Estonia the S-SO_4 concentration ranges between below 50% and 100% of the average concentration measured for the previous five years. For two plots in Germany and three plots in Finland the reported concentrations were above 126% of the average concentration measured for the previous five years. Data for 2001 were also available for plots in Germany, Italy and Spain, but no values were available for any of the previous five years.

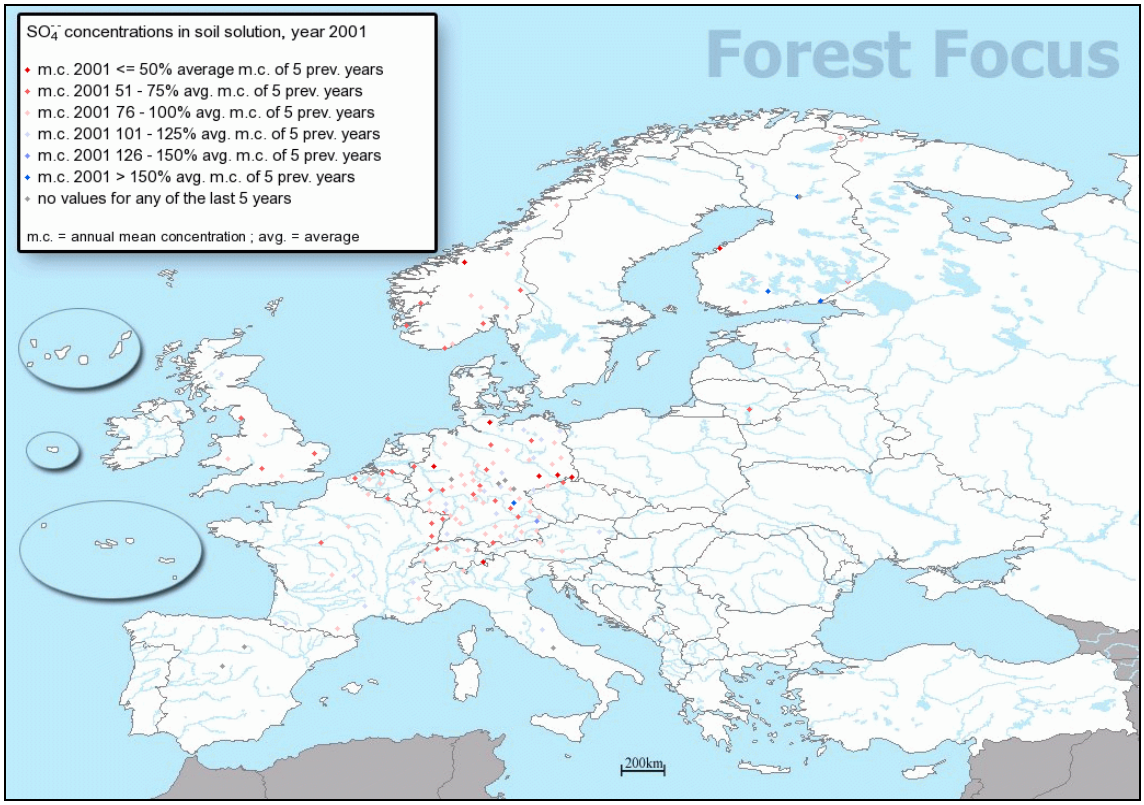

Figure 7: Breaks on SO_4 Concentrations in Soil Solution

$N\text{-}NO_3$ concentrations are mapped in Figure 8. The majority of nitrate concentrations reported are below 50% of the average concentration measured for the previous five years. These are almost all plots in Norway. Furthermore such plots can be found mainly in Germany, but also in other parts of Europe. For several plots, concentrations above 150% were observed, namely in Germany, France, United Kingdom and on one plot each in Finland, Norway and Lithuania. There were no values for any of the last five years in Finland, Germany and Spain.

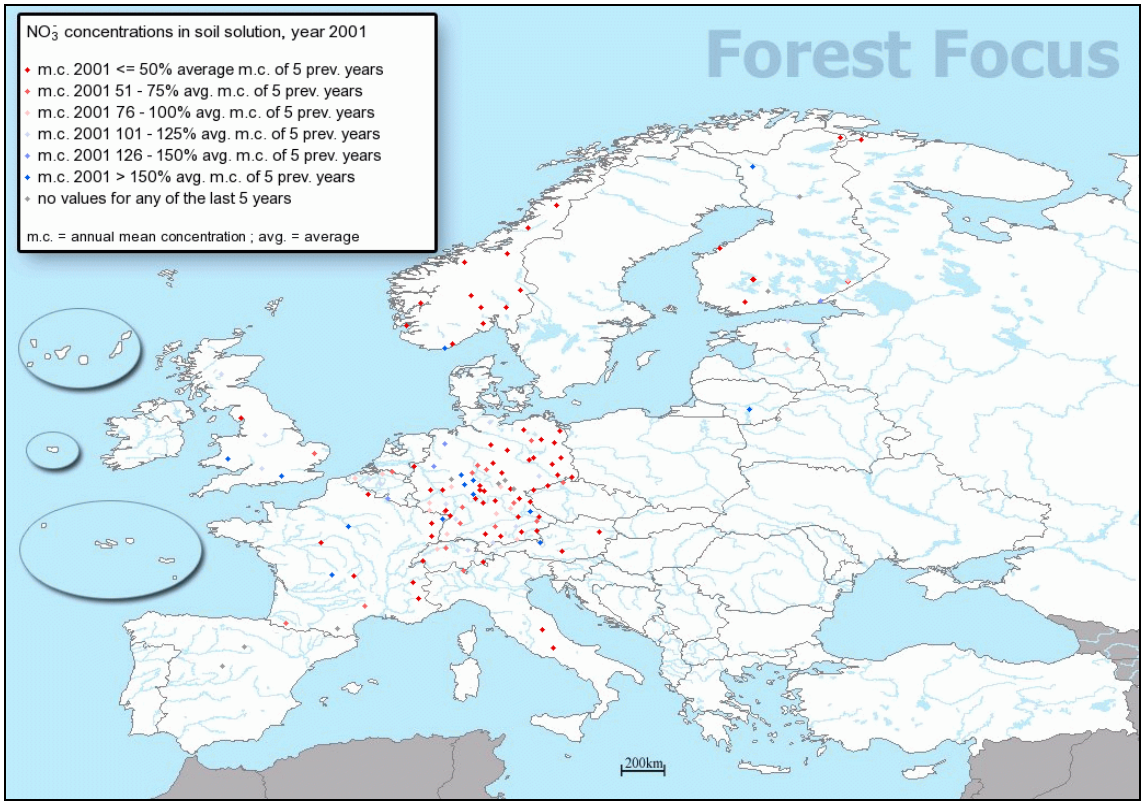

Figure 8: Breaks on NO_3 Concentrations in Soil Solution

The data monitored for N-NH_4 are mapped in Figure 9. The geographic distribution of plots with available data and the observed trend for ammonium concentrations is similar to that found for nitrate. For the majority of plots the NH_4 concentrations reported are below 50% of the average concentration measured for the previous five years. Most of those plots are located in Germany and also in Finland, Italy, United Kingdom and in central Europe. Furthermore some plots with concentrations above 150% were detected in Finland, Germany and France.

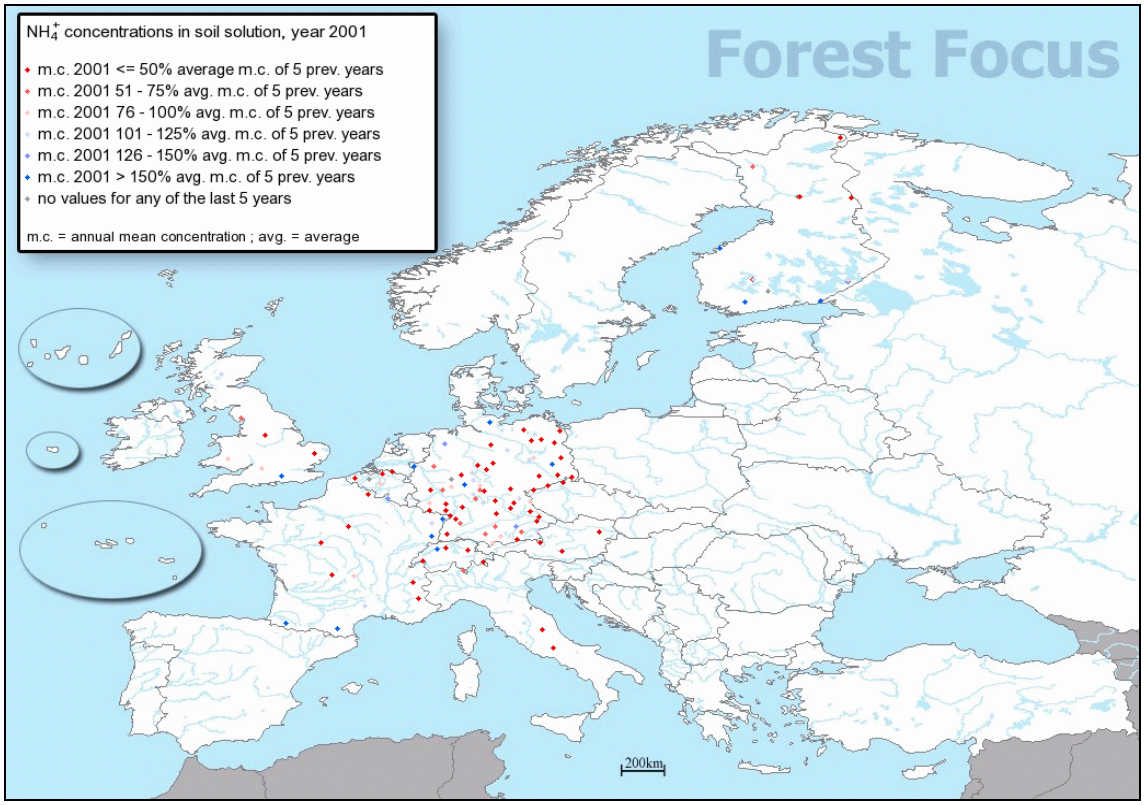

Figure 9: Breaks on NH_4 Concentrations in Soil Solution

3.4.3 Foliar Condition

Concentrations of nitrogen and sulphur are mapped for *Pinus sylvestris*, *Picea abies*, *Fagus sylvatica*, *Quercus robur* and *Q. petraea*, *Quercus ilex* and *Qu. rotundifolia*, and *Pinus pinaster*. For each reporting year, mean plot concentrations are calculated by species and plot and are then classified into five classes of equal relative frequency (pentiles). The minimum of the first class is the minimum of the measured values, the maximum of fifth class is the maximum of the measured values.

The foliar concentrations of nitrogen and of sulphur in needles of *Pinus sylvestris* in the year 2001 are mapped in Figure 10 and Figure 11. The majority of the plots are situated in Poland and in eastern Germany. Measured nitrogen concentrations range from 8.7 to 26.1 g/kg. The highest nitrogen concentrations ranging from 17.495 to 26.1 g/kg are measured on plots in Poland and Western Europe. In Western Europe, particularly in The Netherlands and in Belgium, high nitrogen concentrations may be attributed to ammonium depositions resulting from animal husbandry. In Poland several plots of high nitrogen concentrations are situated in Sub-alpine mountain ranges bordering the Czech Republic and the Slovak Republic. In contrast, the eastern and western parts of Poland show mainly plots of low nitrogen concentrations in needles of *Pinus sylvestris* ranging from 8.7 to 14.11 g/kg. The plots in Finland show almost exclusively concentrations within this lowermost pentile.

The concentrations of sulphur in the needles of *Pinus sylvestris* range from 0.635 to 1.910 g/kg. Similar to the nitrogen concentrations, several plots of high sulphur concentrations in Poland are situated in Sub-alpine mountain ranges bordering the Czech Republic and the Slovak Republic. This pattern coincides partly with the one of sulphate depositions in this region, suggesting an impact of industrial emissions. Also similar to the nitrogen concentrations, the spatial pattern of sulphur concentrations in needles of *Pinus sylvestris* show high spatial variability. Besides the plots with highest sulphur concentrations, also many plots within the range of the lowermost pentile occur in Poland, with concentrations ranging from 0.635 to 1.010 g/kg. Plots in Finland and eastern Germany show concentrations mainly within this lowermost pentile.

The high variation of element concentrations in needles of *Pinus sylvestris* reported by Poland is not suspected to be a data quality problem, as the Polish laboratories have qualified for the analyses in several ring tests.

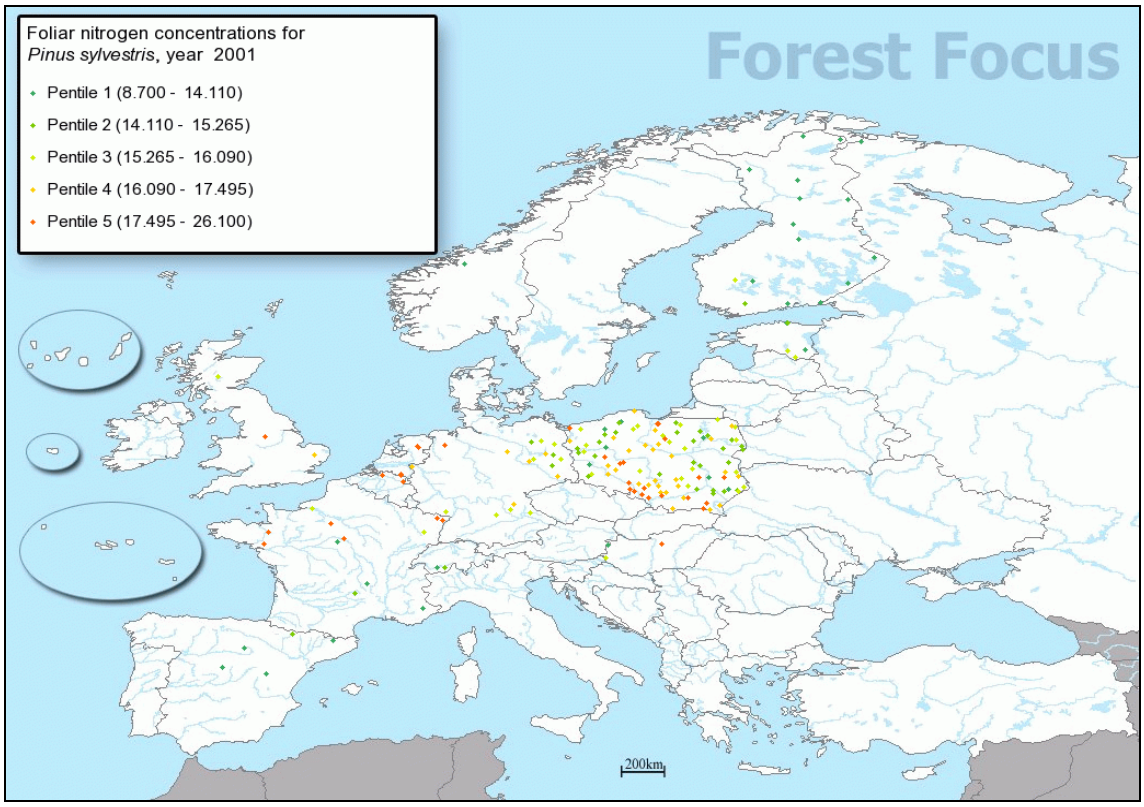

Figure 10: Foliar Nitrogen Concentrations for Pinus Sylvestris

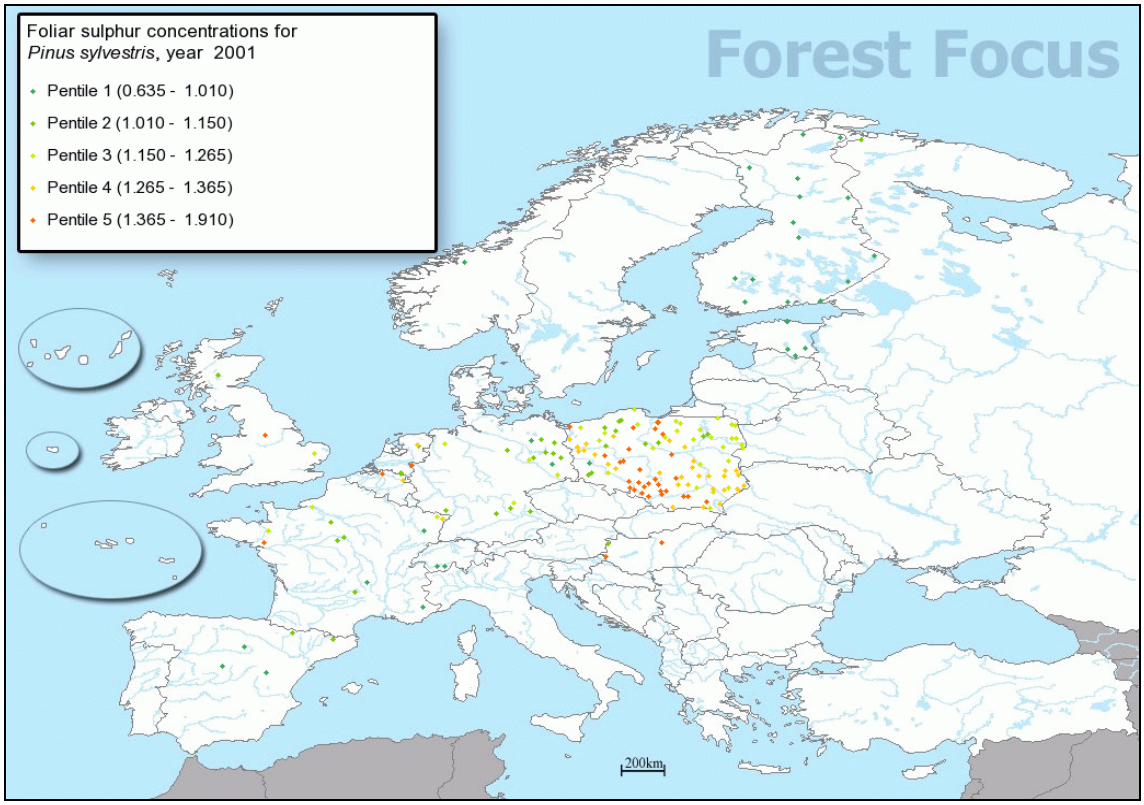

Figure 11: Foliar Sulphur Concentrations for Pinus Sylvestris

The plots of *Picea abies* assessed for foliar concentrations of nitrogen and sulphur are mainly situated in the Alpine regions of Switzerland, Austria and southernmost Germany, as well as in the Sub-alpine mountain ranges of southern Germany and the border between Poland, the Czech Republic and the Slovak Republic (see Figure 12 and Figure 13). The spatial variability of element concentrations in needles of *Picea abies* is as high as that in needles of *Pinus sylvestris*. Nitrogen concentrations range from 9.100 to 19.560 g/kg and sulphur concentrations range from 0.645 to 2.405 g/kg. Concentrations of both nitrogen and sulphur are lowest in northern Europe, in south-western Germany and in Switzerland and Austria. For nitrogen they lie between 9.100 and 12.855 g/kg. For sulphur they range from 0.645 to 0.900 g/kg.

The foliar concentrations of nitrogen and of sulphur in leaves of *Fagus sylvatica* in the year 2001 are mapped in Figure 14 and Figure 15, respectively. The number of *Fagus sylvatica* plots is smaller than that of *Pinus sylvestris* and *Picea abies* and the plots are scattered mainly across central Europe.

Nitrogen concentrations in *Fagus sylvatica* leaves range from 19.000 to 32.530 g/kg. Plots with low concentrations of 19.000 to 23.610 g/kg are most abundant in central Germany. Most plots in the other regions of Europe show higher nitrogen concentrations.

Sulphur concentrations are about an order of magnitude lower than the nitrogen concentrations and range between 0.300 and 3.250 g/kg. Also the plots showing the

lowest sulphur concentrations (0.300 to 1.510 g/kg) are situated in central Germany. Several plots with highest sulphur concentrations (1.800 to 3.250 g/kg) are situated in the Sub-alpine mountain ranges between Poland, Czech Republic and Slovak Republic.

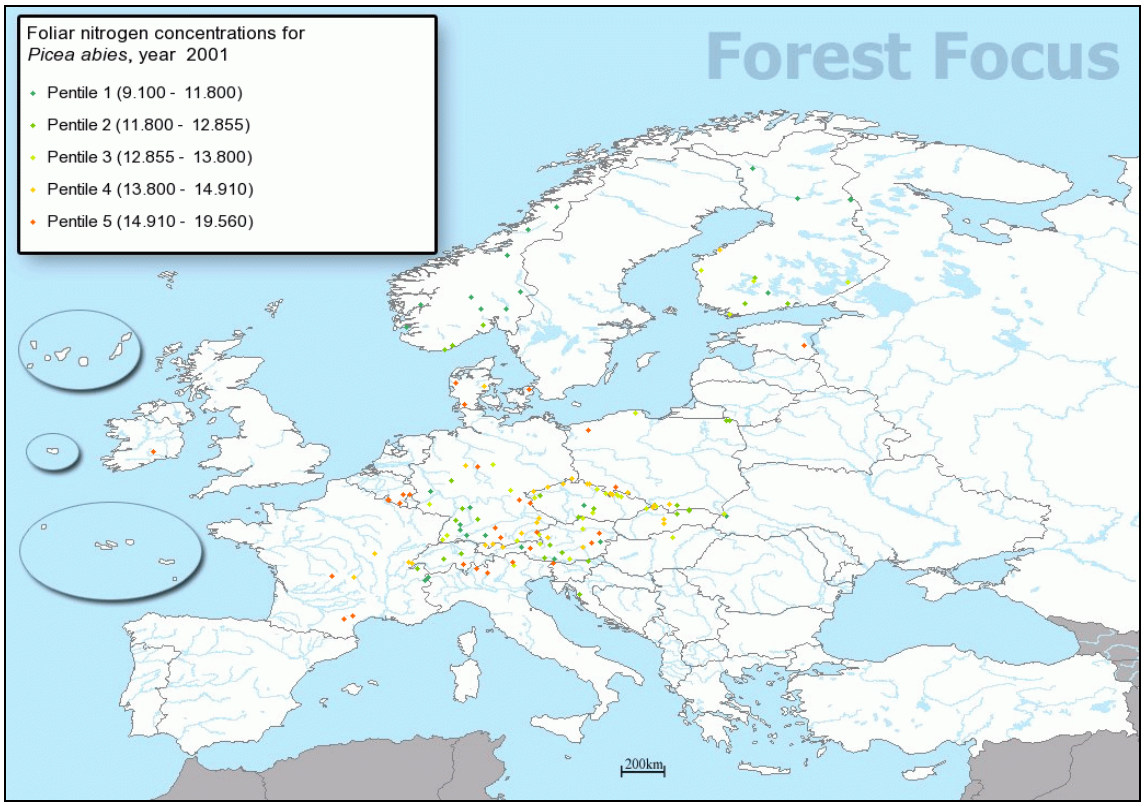

Figure 12: Foliar Nitrogen Concentrations for Picea Abies

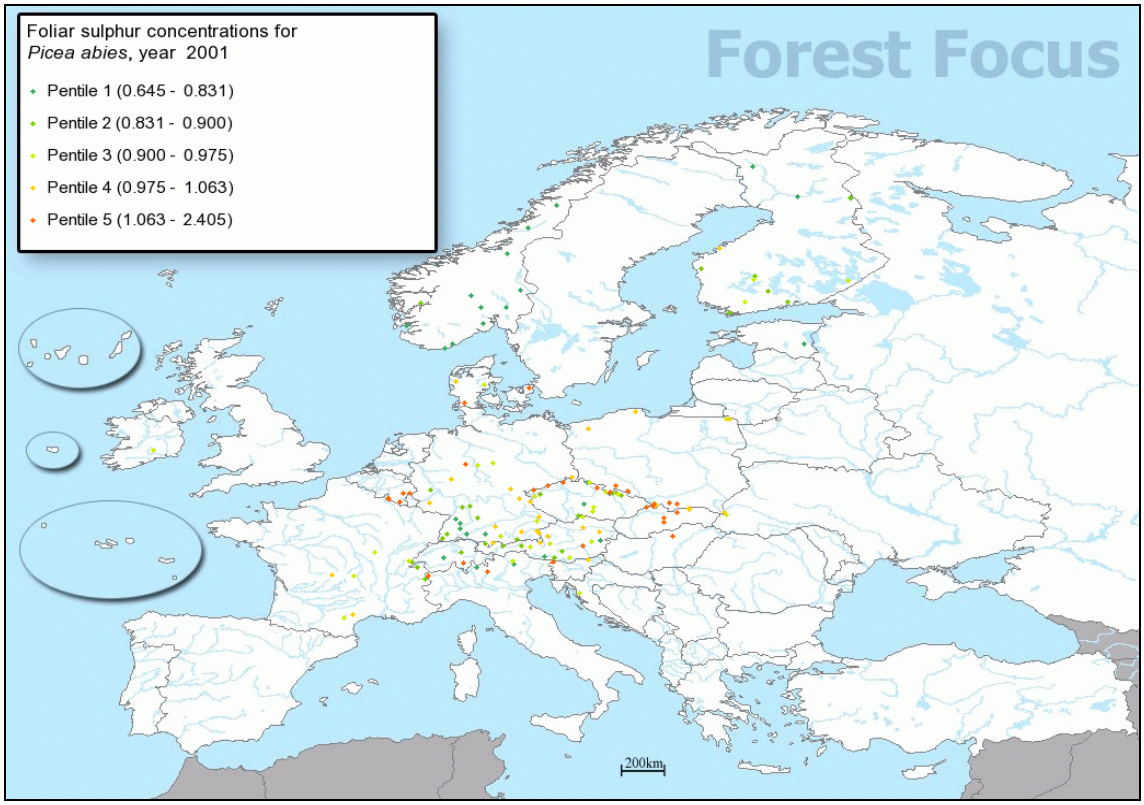

Figure 13: Foliar Sulphur Concentrations for Picea Abies

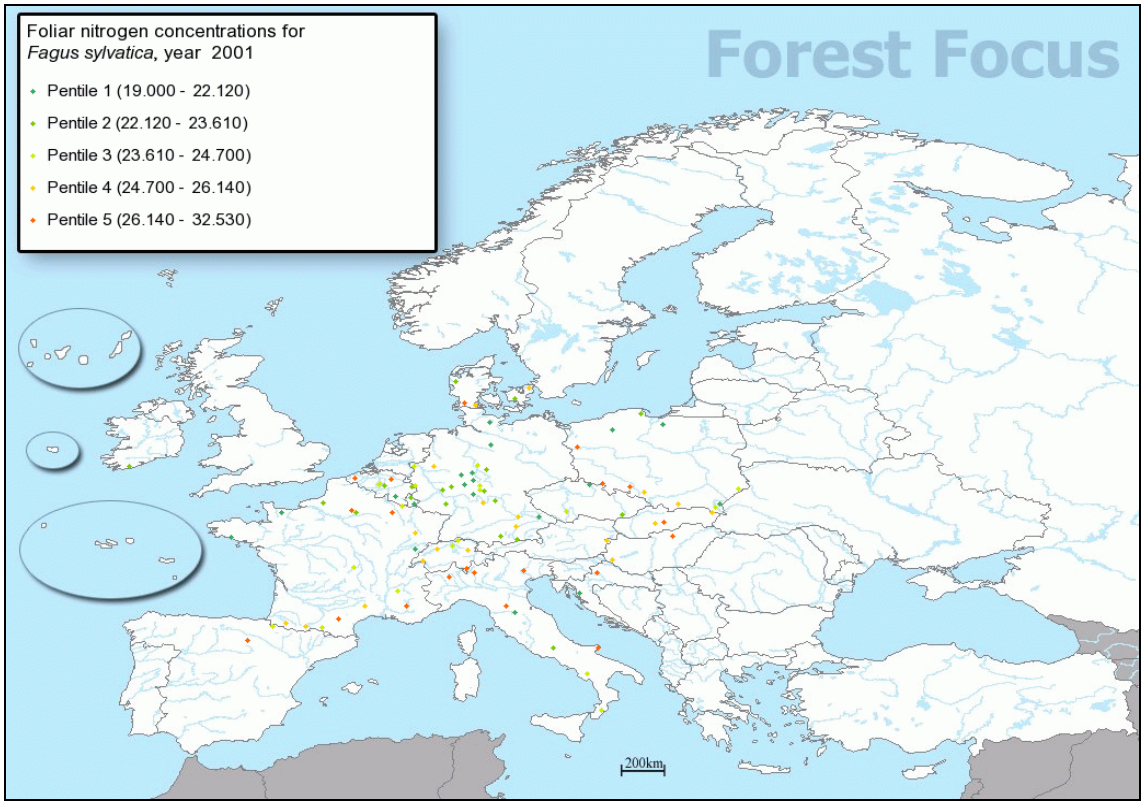

Figure 14: Foliar Nitrogen Concentrations for Fagus Sylvatica

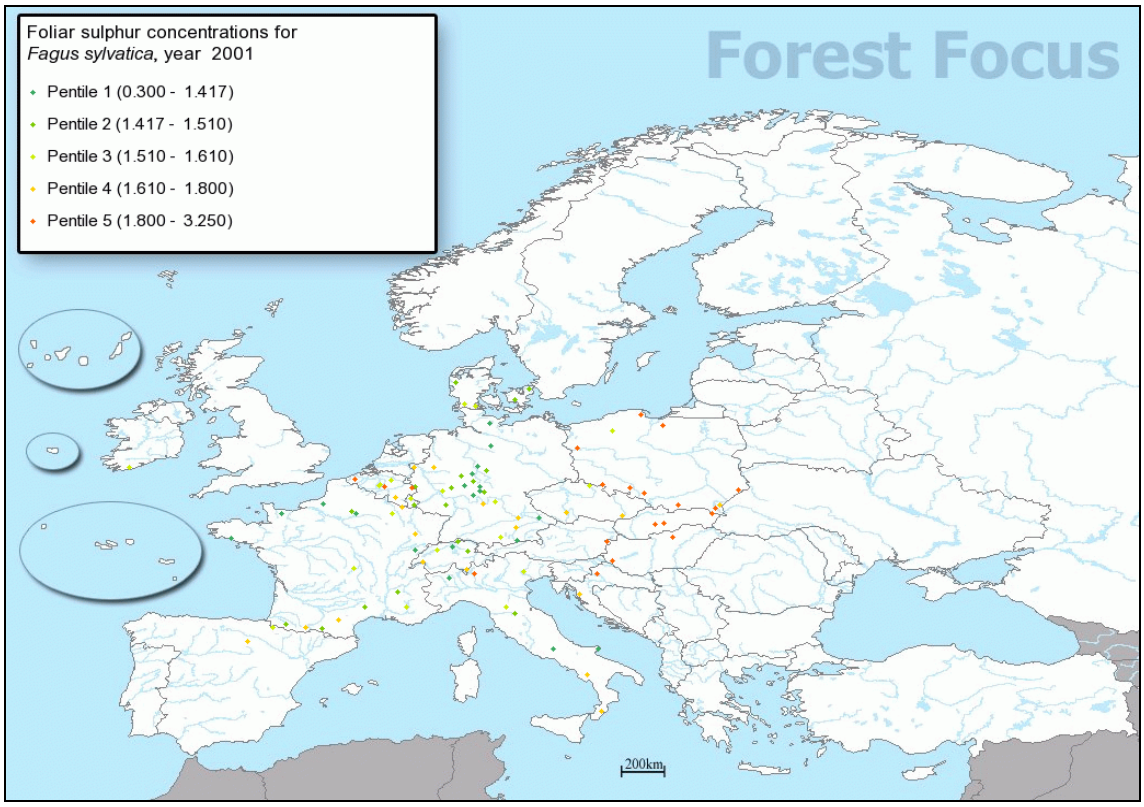

Figure 15: Foliar Sulphur Concentrations for Fagus Sylvatica

Figure 16 and Figure 17 show the spatial variation of foliar concentrations of nitrogen and of sulphur in leaves of *Quercus robur and Quercus petraea* in the year 2001. Similar to *Fagus sylvatica*, the number of *Quercus robur* and *Quercus petraea* plots is smaller than that of *Pinus sylvestris* and *Picea abies.* The plots are scattered mainly across central and western Europe.

Nitrogen concentrations in *Quercus robur and Quercus petraea* leaves range from 20.200 to 33.380 g/kg. Sulphur concentrations being about an order of magnitude lower than the nitrogen concentrations lie between 1.290 and 3.400 g/kg.

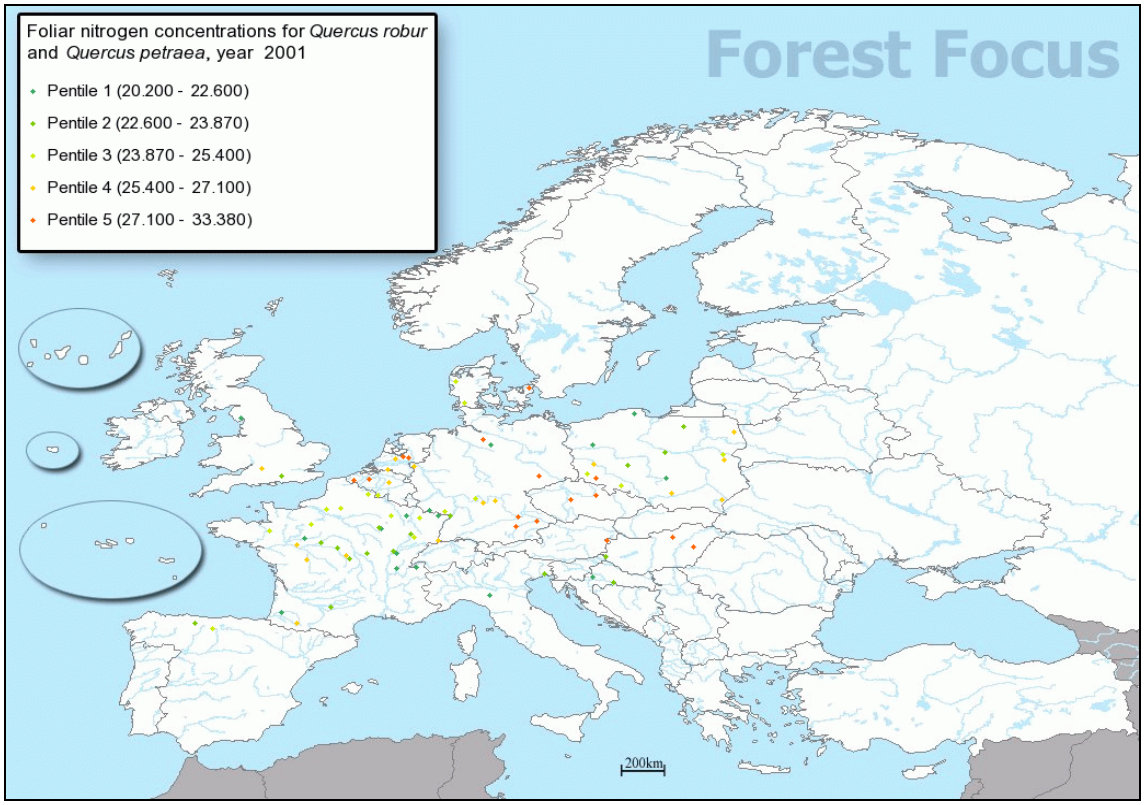

Figure 16: Foliar Nitrogen Concentrations for Quercus Robur and Qu. Petraea

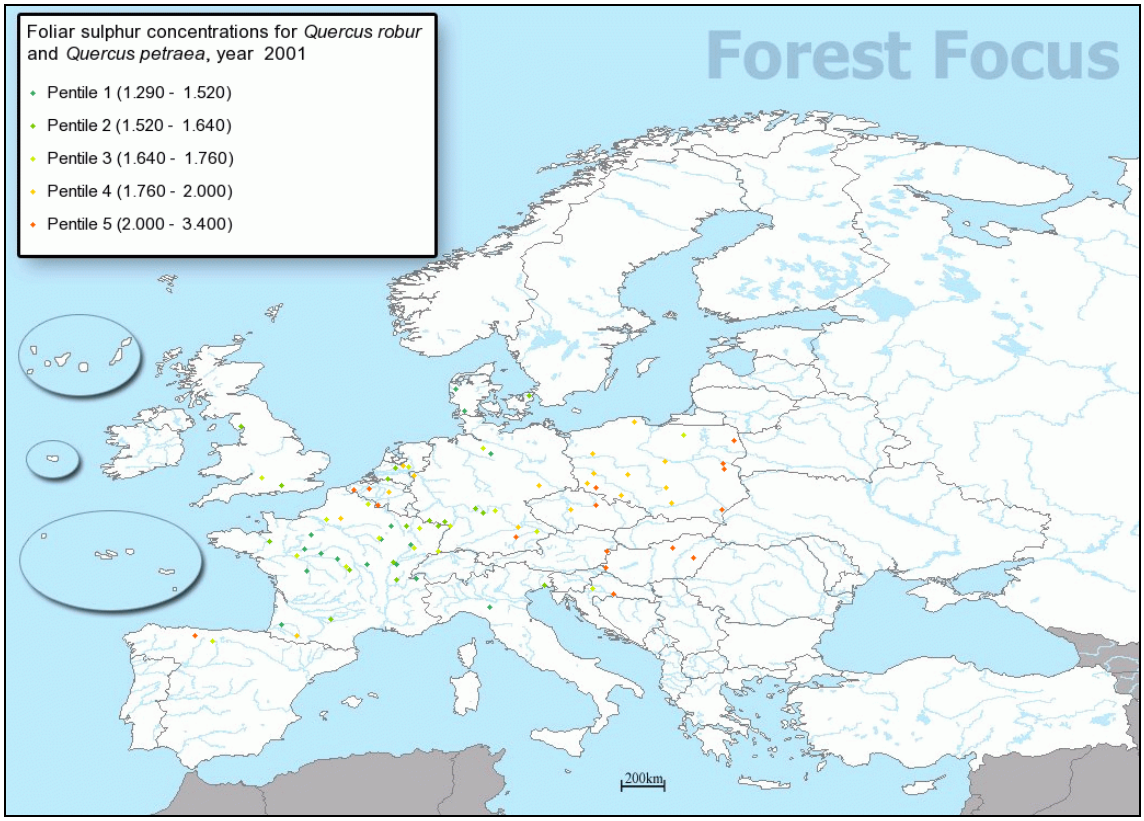

Figure 17: Foliar Sulphur Concentrations for Quercus Robur and Qu. Petraea

3.4.4 Deposition

The difference between the quantity weighted mean concentration in 2001 and the average of the weighted mean concentrations of the five preceding years is presented for 2001. In central Europe the density of plots for which quantity weighted mean concentrations in bulk deposition could be validated for the year 2001 is high enough to reveal clear spatial patterns. These patterns of concentrations of $S\text{-}SO_4$, $N\text{-}NO_3$, and $N\text{-}NH_4$ in bulk deposition are shown in Figure 18, Figure 19 and Figure 20, respectively. They coincide largely with the spatial patterns of concentrations and depositions of the same three elements described by ICP Forests in several of its annual reports (Lorenz *et al.* 2005, 2006 and 2007).

As depicted in Figure 18 plots of highest $S\text{-}SO_4$ concentrations ranging from 1.414 to 6.899 mg/l prevail in a region covering large parts of Poland and extending into the Czech Republic and the Slovak Republic. Some of these plots are also found in northern Germany and in Belgium. Depositions of $S\text{-}SO_4$ in Belgium could be shown by ICP Forests to be correlated with Na depositions pointing at sea salt as an origin of sulphur inputs. Concentrations decrease from central Europe towards the north and southwest of Europe. Plots of lowest concentrations ranging from 0.090 to 0.395 mg/l are particularly

frequent in Switzerland, Austria and southern Germany. They dominate in northern and in south-western Europe.

The spatial patterns of the nitrogen concentrations are similar to those of the sulphur concentrations and shown in Figure 19. Plots of highest $N\text{-}NO_3$ concentrations ranging from 0.617 to 3.015 mg/l are most frequent in Poland and parts of the Czech Republic, the Slovak Republic and Germany. Smaller numbers of these plots are found in northern Italy and loosely scattered across Sweden.

Also the plots of highest $N\text{-}NH_4$ concentrations between 1.357 and 8.347 mg/l are particularly numerous in Poland, as shown in Figure 20. Plots with lowest concentrations of the two nitrogen compounds are most frequent in a region covering Switzerland, Austria and southern Germany. They also prevail in parts of Poland as well as in south-western and northern Europe.

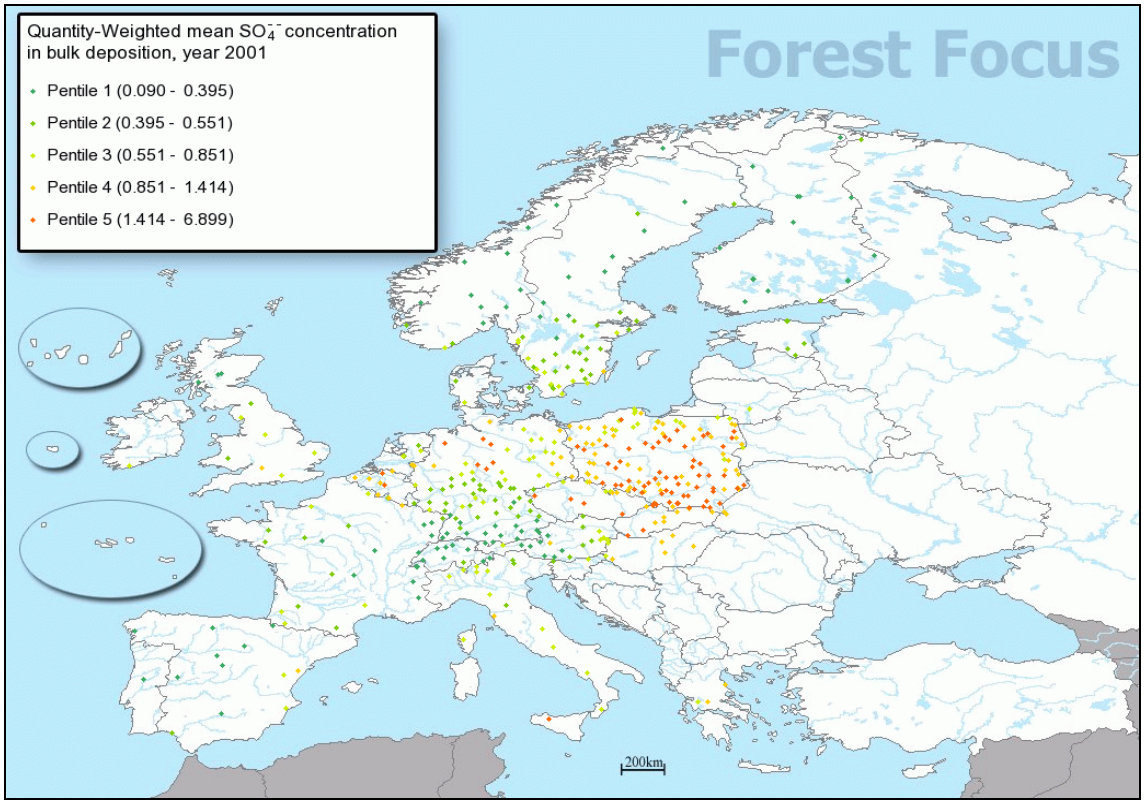

Figure 18: Quantity-Weighted Mean SO_4 Concentration in Bulk Deposition

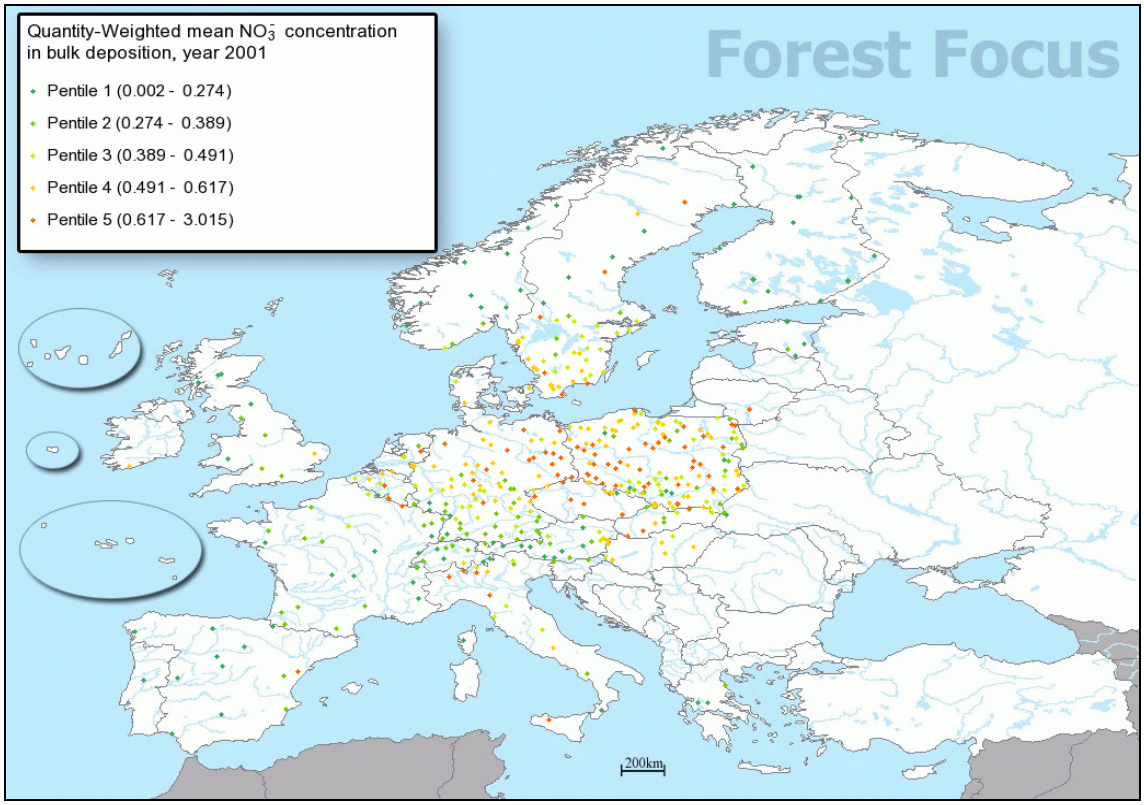

Figure 19: Quantity-Weighted Mean NO_3 Concentration in Bulk Deposition

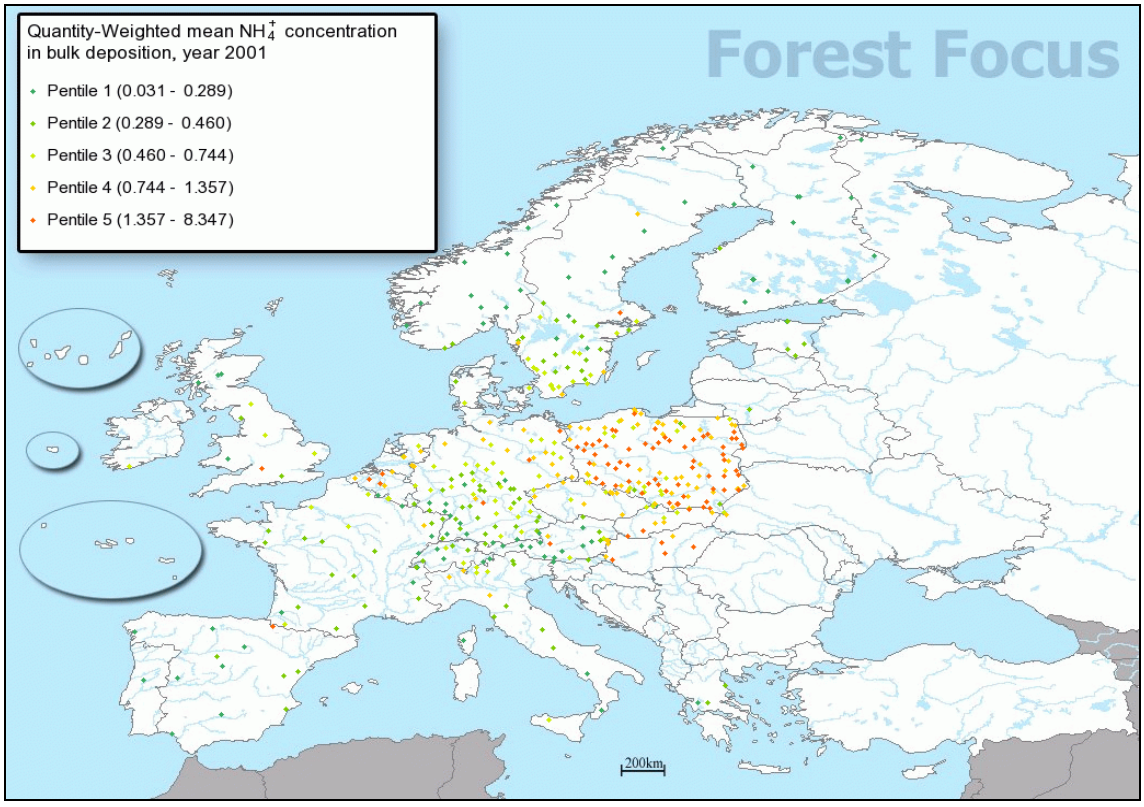

Figure 20: Quantity-Weighted Mean NH_4 Concentration in Bulk Deposition

The data for deviations in the quantity-weighted mean depositions of the monitoring year from the average deposition reported over the previous 5 years are presented for the three selected parameters in Figure 21 ($S\text{-}SO_4$), Figure 22 ($N\text{-}NO_3$) and Figure 23 ($N\text{-}NH_4$). For the overwhelming majority of the plots the element concentrations in bulk deposition in the year 2001 are below the average values of the previous 5 years. This situation is particularly obvious for sulphate and less obvious for nitrate and ammonium. It reflects the finding by ICP Forests that concentrations in bulk deposition decreased clearly for sulphur and less obviously for ammonium and nitrogen (Lorenz *et al*. 2004). A small number of plots show an increase in concentrations in comparison to the previous five years. However, the respective 2001 values were not found to be outside the range of observations.

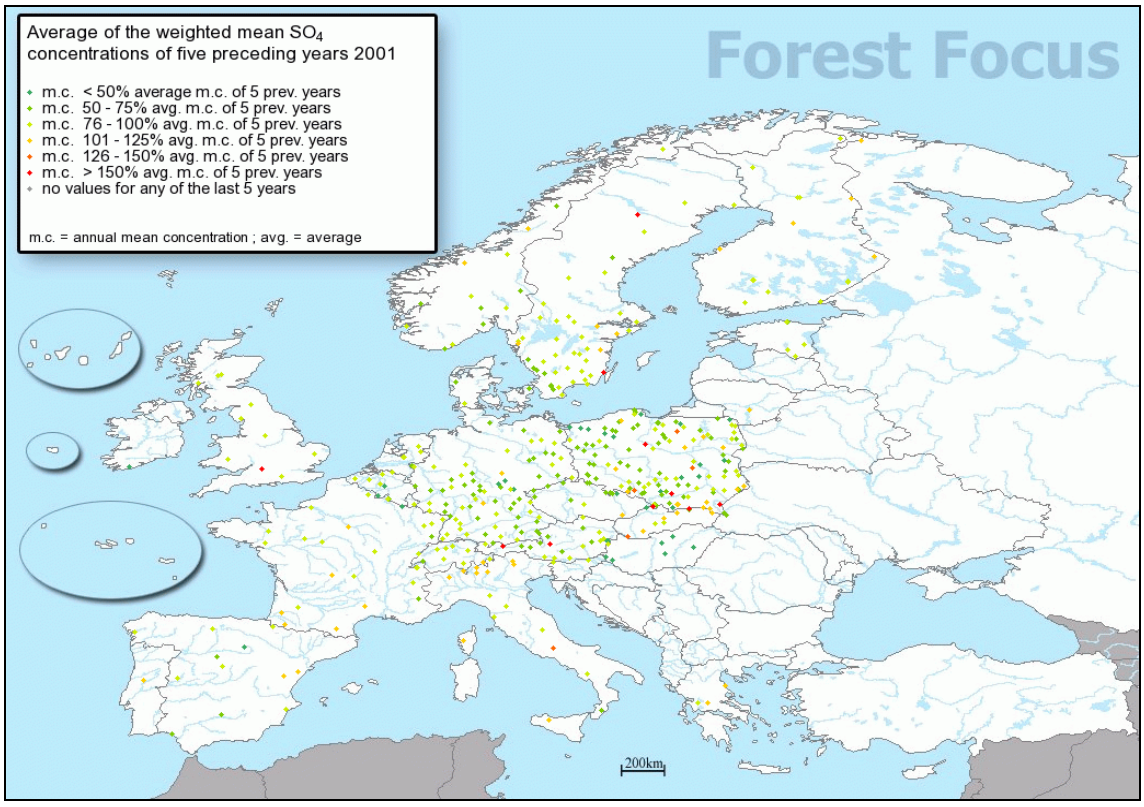

Figure 21: Average of Weighted Mean SO_4 Concentration over 5 Years

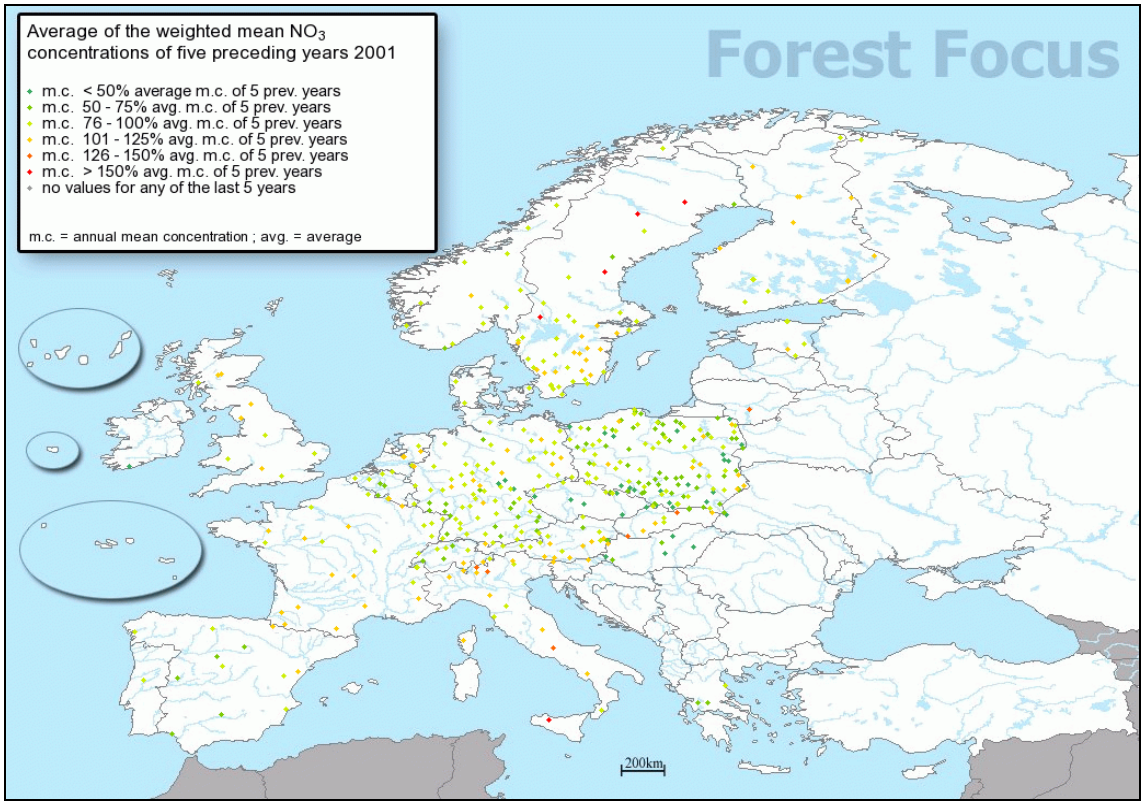

Figure 22: Average of Weighted Mean NO_3 Concentration over 5 Years

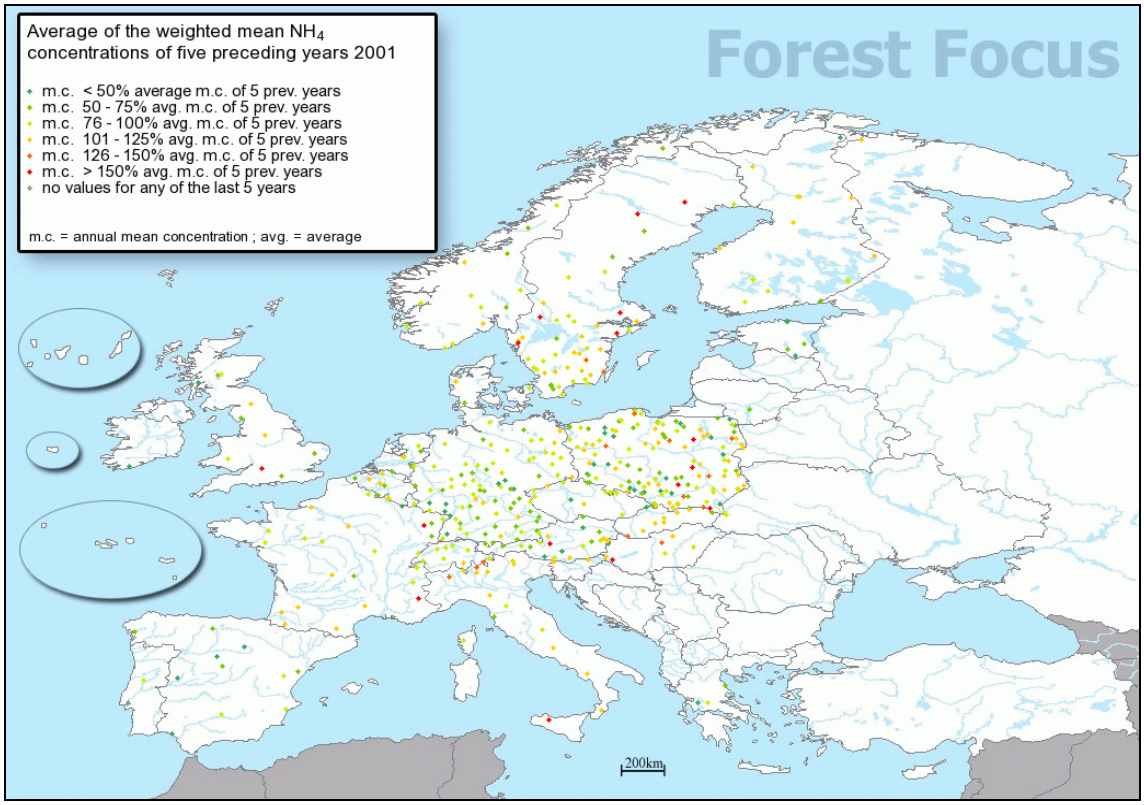

Figure 23: Average of Weighted Mean NH_4 Concentration over 5 Years

3.5 Data Stored in Forest Focus Monitoring Database

The legacy data provided in the exported ASCII files have been imported into the FFMDb as received. The upload includes all data from the 114 surveys for 2001. In order to be consistent with other Technical Reports on overview of the surveys is given in Table 4.

Table 4: 2001 Legacy Data Uploaded to the FFMDb

Country	Survey									
	SI	CC	SO	SS	FO	GR	DP	MM	GV	AQ
AD										
AT		✓		✓	✓		✓	✓	✓	
BG										
BY										
CH		✓		✓	✓		✓	✓		
CS										
CY										
CZ		✓		✓	✓		✓	✓		
DE		✓		✓	✓	✓	✓	✓	✓	
DK		✓		✓	✓		✓	✓		✓
EE		✓		✓	✓		✓		✓	
ES		✓		✓	✓		✓	✓		✓
FI		✓		✓	✓		✓	✓	✓	
FR		✓		✓	✓	✓	✓			✓
GR		✓			✓		✓	✓		
HR		✓			✓					
HU		✓			✓		✓	✓	✓	
IE		✓			✓	✓				
IT		✓		✓	✓		✓	✓	✓	
LT		✓		✓			✓			
LU		✓			✓		✓	✓		✓
LV										
MD										
NL		✓		✓	✓		✓			
NO		✓		✓	✓		✓			
PL		✓			✓		✓			
PT		✓			✓		✓		✓	
RO										
RU										
SE		✓		✓			✓	✓		
SI										
SK		✓			✓	✓	✓			
UK		✓		✓	✓		✓	✓	✓	
BE		✓		✓	✓		✓	✓		
Total	**0**	**24**	**0**	**16**	**22**	**4**	**22**	**14**	**8**	**4**

3.6 Specific Considerations for Legacy Data

Specific considerations for the evaluation and data processing of 2001 legacy data are briefly described hereunder. More detailed technical information may be found in the related *2001 Technical Report*.

3.6.1 Submission Method of Legacy Data

During the validation of Forest Focus data it transpired that some data in the database do not appear to correspond to the data assumed to be sent by NFCs at the time as data submissions. This situation is noticeable for static parameters, such as plot coordinates and tree species. It is much less evident to what degree variable parameters are affected by the condition.

Sources for the inconsistency between data assumed to be submitted by an NFC and found in the database are numerous. One source is the use of physical storage media for transmitting data. The date of data processing, of writing files to the media and of sending the CDs or floppy disks is necessarily different. An earlier version can be sent at a later date than a more up-to-date version of a file. It is also very comfortable to copy data between years, which can then lead to a continuation of data irregularities. This seems to have happened in some cases of plot coordinates.

3.6.2 Legacy Database Export Format

The legacy data were stored in an Oracle database. The various tables were exported into ASCII files and no database dump file was made available. As a consequence, all links were lost, the original database could not be recreated and the completeness of the data cannot be verified. Also lost was information stored in the comment field. Some NFCs followed a recommendation to store actual values in the comment field - to what degree such data were moved from the comment field into the parameter field is not known and cannot be reconstructed.

3.6.3 Effect of Legacy Data on Subsequent Data Validation

All legacy data have to be considered validated. They are part of the validation process under Forest Focus in as much as they are included in the time series analysis of the Conformity and Uniformity Checks. When verifying data consistency of static parameters during the validation process of the data from the monitoring year 2002 to 2004 it became obvious that in some cases the legacy data was different from later data. In these cases, messages were triggered by the tests of the Conformity Check for the respecting year although the data submitted for the later year were correct. These data

were uploaded after the confirmation by the NFC in the database and were the reference for the following monitoring years.

3.6.4 Up-dating Legacy Data

Several requests have been received for up-dates of values in the legacy data. Such a data maintenance procedure is technically possible. However, it would be a deviation from the principle of not making any modifications to the data submitted by NFCs. This approach has the advantage that no information would be dropped from the database.

Up-dates of values for variable parameters and adapted coding for missing data could improve the value of the database. The problem posed by such modifications is the status of the data.

The problem of up-dating the database is not restricted to legacy data, but also affects data processed under Forest Focus.

4 SUMMARY AND RECOMMENDATIONS

For data from the 2001 monitoring year a total of 114 surveys received by 24 NFCs are stored in the Forest Focus Monitoring Database. In total 287 forms from 8 surveys were tested for Conformity and Uniformity. The intensity of data submissions for the surveys ranges from four for Growth and Air Quality to 24 for the Crown Condition survey.

Since 2001 data had to be assumed to be validated the data could only be evaluated using the procedures developed for validating Forest Focus data. The Compliance Check on data formats is not applicable to the legacy data. Data can, however, be evaluated on the basis of the Conformity and Uniformity Checks. This process allows highlighting outliers in the data or values which could affect the validation of data from subsequent years. The evaluation of the legacy data from 2001 would thus allow a better understanding of the data quality for further analyses. The information obtained from communications with NFC during the validation process of the data from the monitoring years 2002 to 2005 allowed in most cases to explain the reasons for the messages raised by the tests.

More than 80% of the warning and error messages generated by the various tests for Conformity were found in the data of the Meteorology survey, mainly caused by values outside the expected ranges. Very few inaccuracies were found in the legacy data of the monitoring year 2001. This was to be expected because the data were already validated, although using a different procedure from Forest Focus. Most situation causing error messages can be plausibly explained. The main reason for error messages were changes in presumed static parameters, such as the occurrence of new trees on the plots or changes in plot coordinates or altitude. Anomalies from the generally expected trend, e.g. shrinking trees, could usually be declared extreme events or inaccuracy in measuring. In those cases were legacy data were already declared as incorrect by the respecting NFC this circumstance is mentioned in the report, but the data have not been modified in any way in the FFMDb.

In contrast to the monitoring years under Forest Focus the coding of missing data and values below the detection/quantification limits with “-1” is totally absent from the legacy data. Also the use of a zero value to indicate the absence of a measurement seems to have been applied very infrequently.

In cases where data from the monitoring years 2002 to 2005 triggered messages due to wrong or less accurate entries in the legacy data, these data were uploaded after the confirmation by the NFC in the database and became the reference in the checks for the following monitoring years.

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Abstract

This *Executive Summary Report* for 2001 Level II legacy data supplements the *Technical Report* for the same monitoring year. It presents a concise account of the results obtained from evaluating the legacy data when subjected to Forest Focus Conformity and Uniformity Checks. Specific problems encountered and particularities with significant consequence on the validation of data form subsequent monitoring years are included in the report. For details and technical background of the data and the evaluation process the *2001 Technical Report* should be referred to.

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